AMENDMENT UNDER 37 C.F.R. § 1.116
U.S. APPLICATION NO. 09/556,349
ATTORNEY DOCKET NO. CA1055

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (*Currently Amended*) A method for summarizing a content of an input video sequence, said method comprising:

(a)   computing a feature vector for each frame in a set of frames from said input video sequence; ~~and~~

(b)   applying singular value decomposition to a matrix comprised of said feature vectors and projecting the matrix on a refined feature space representation, wherein positions of said projections on said refined feature space representation represent approximations of visual changes in said set of frames from said input video sequence;

(c)   clustering said frames of said input video sequence based upon positions of said projections on said refined feature space representation;

(d)   selecting a frame from each cluster to serve as a keyframe in a summarization of said input video sequence; and

(e)   using said clustered frames to output a motion video representative of a summary of said input video sequence, wherein said input video sequence summary is composed according to a time-length parameter T_{len} and a minimum display time parameter T_{min} by:

locating the video shot Θ_i in each cluster S_i having the greatest length;

determining how the video shots in each cluster will be arranged according to

$C \leq N = T_{len}/T_{min}$.

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wherein C represents a number of clusters; and

wherein N represents the maximum number of video shots;

if $C \leq N$, then all the video shots in each cluster is included in said input video

sequence summary; and

if $C > N$, then sort each video shot Θ_i from each cluster S_i in descending order by

length, select the first N video shots for inclusion in said input video sequence summary and

assign time length T_{lin} to each selected video shot.

2-6. (*Cancelled*).

7. (*Currently Amended*) The method of claim $\underline{1}$[[6]], wherein said singular value

decomposition is performed using frames selected with a fixed interval from said input video

sequence.

8. (*Cancelled*).

9. (*Previously Presented*) The method of claim 1. wherein each column of said matrix

represents a frame in said refined feature space representation.

10-30. (*Cancelled*).

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31. (*Currently Amended*) A computer-readable medium containing a program for

summarizing a content of an input video sequence, said program comprising:

(a)   computing a feature vector for each frame in a set of frames from said input video

sequence; and

(b)   applying singular value decomposition to a matrix comprised of said feature

vectors and projecting the matrix on a refined feature space representation, wherein positions of

said projections on said refined feature space representation represent approximations of visual

changes in said set of frames from said input video sequence;

(c)   clustering said frames of said input video sequence based upon positions of said

projections on said refined feature space representation;

(d)   selecting a frame from each cluster to serve as a keyframe in a summarization of

said input video sequence; and

(e)   using said clustered frames to output a motion video representative of a summary

of said input video sequence, wherein said input video sequence summary is composed

according to a time-length parameter T_{len} and a minimum display time parameter T_{min} by:

locating the video shot Θ_i in each cluster S_i having the greatest length;

determining how the video shots in each cluster will be arranged according to

$C \leq N = T_{len}/T_{min}$;

wherein C represents a number of clusters; and

wherein N represents the maximum number of video shots;

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if $C \leq N$, then all the video shots in each cluster is included in said input video

sequence summary; and

if $C > N$, then sort each video shot Θ_i from each cluster S_j in descending order by

length, select the first N video shots for inclusion in said input video sequence summary and

assign time length T_{min} to each selected video shot.

32-36. (*Cancelled*).

37. (*Previously Presented*) The computer-readable medium of claim 31, wherein said

singular value decomposition is performed using frames selected with a fixed interval from said

input video sequence.

38. (*Cancelled*).

39. (*Previously Presented*) The computer-readable medium of claim 31, wherein each

column of said matrix represents a frame in said refined feature space representation.

40-72. (*Cancelled*).

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73. (*Previously Presented*) The method of claim 1, wherein said feature vectors are

computed using a color histogram that outputs a histogram vector.

74. (*Previously Presented*) The method of claim 73, wherein said histogram vector is

indicative of a spatial distribution of colors in said each of said frames.

75. (*Previously Presented*) The method of claim 74, wherein each of said frames is

divided into a plurality of blocks, each of said plurality of blocks being represented by a

histogram in a color space indicative of a distribution of colors within each of said blocks.

76. (*Previously Presented*) The method of claim 74, wherein each of said frames is

divided into a plurality of blocks and said histogram vector comprises a plurality of histograms

in a color space, each of said plurality of histograms corresponding to one of said plurality of

blocks.

77-78. (*Cancelled*).

79. (*Currently Amended*) The method of claim 1[[78]], wherein said selecting a frame

comprises locating a frame with a feature vector that projects into a singular value that is most

representative of other singular values of the cluster.

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80-82. (*Cancelled*).

83. (*Currently Amended*) The method of claim 1[[82]], wherein the composition of said

input video sequence summary further comprises sorting the selected video shots by their

respective time codes.

84. (*Previously Presented*) The method of claim 83, wherein the composition of said

input video sequence summary further comprises extracting a portion of selected video shot

equal in length to time length T_{min} and inserting each extracted portion in order to said input

video sequence summary.

85. (*Currently Amended*) The method of claim 1[[77]], wherein said clustering of said

frames further comprises using a position of the most static shot of said input video sequence to

compute a value as a threshold during the clustering of said frames.

86. (*Previously Presented*) The method of claim 85, wherein said clustering of said

frames further comprises computing a content value and using said computed content value to

cluster the remaining frames by:

sorting said feature vectors in said refined feature space representation in ascending order

according to a distance of each of said feature vectors to an origin of said refined feature space

representation;

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selecting a vector among said sorted feature vectors which is closest to an origin of said

refined feature space representation and including said selected feature vector into a first cluster;

clustering said plurality of sorted feature vectors in said refined feature space

representation into a plurality of clusters according to a distance between each of said plurality of

sorted feature vectors and feature vectors in each of said plurality of clusters and an amount of

information in each of said plurality of clusters.

87. (*Previously Presented*) The method of claim 86, wherein, in said clustering of sorted

feature vectors, said plurality of sorted feature vectors are clustered into said plurality of clusters

such that said amount of information in each of said plurality of clusters does not exceed an

amount of information in said first cluster.

88. (*Previously Presented*) The method of claim 86, wherein said first cluster is

composed of frames based on a distance variation between said frames and an average distance

between frames in said first cluster.

89. (*Previously Presented*) The method of claim 86, wherein each of said plurality of

clusters is composed of frames based on a distance variation between said frames and an average

distance between frames in said each of said plurality of clusters.

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90. (*Previously Presented*) The computer-readable medium of claim 31, wherein said feature vectors are computed using a color histogram that outputs a histogram vector.

91. (*Previously Presented*) The computer-readable medium of claim 90, wherein said histogram vector is indicative of a spatial distribution of colors in said each of said frames.

92. (*Previously Presented*) The computer-readable medium of claim 91, wherein each of said frames is divided into a plurality of blocks, each of said plurality of blocks being represented by a histogram in a color space indicative of a distribution of colors within each of said blocks.

93. (*Previously Presented*) The computer-readable medium of claim 91, wherein each of said frames is divided into a plurality of blocks and said histogram vector comprises a plurality of histograms in a color space, each of said plurality of histograms corresponding to one of said plurality of blocks.

94-95. (*Cancelled*).

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96. (*Currently Amended*) The computer-readable medium of claim 31[[95]], wherein said

selecting a frame comprises locating a frame with a feature vector that projects into a singular

value that is most representative of other singular values of the cluster.

97-99. (*Currently Amended*).

100. (*Currently Amended*) The computer-readable medium of claim 31[[99]], wherein the

composition of said input video sequence summary further comprises sorting the selected video

shots by their respective time codes.

101. (*Previously Presented*) The computer-readable medium of claim 100, wherein the

composition of said input video sequence summary further comprises extracting a portion of

selected video shot equal in length to time length T_{min} and inserting each extracted portion in

order to said input video sequence summary.

102. (*Currently Amended*) The computer-readable medium of claim 31[[94]], wherein

said clustering of said frames further comprises using a position of the most static shot of said

input video sequence to compute a value as a threshold during the clustering of said frames.

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103. (*Previously Presented*) The computer-readable medium of claim 102, wherein said

clustering of said frames further comprises computing a content value and using said computed

content value to cluster the remaining frames by:

sorting said feature vectors in said refined feature space representation in ascending order

according to a distance of each of said feature vectors to an origin of said refined feature space

representation;

selecting a vector among said sorted feature vectors which is closest to an origin of said

refined feature space representation and including said selected feature vector into a first cluster;

clustering said plurality of sorted feature vectors in said refined feature space

representation into a plurality of clusters according to a distance between each of said plurality of

sorted feature vectors and feature vectors in each of said plurality of clusters and an amount of

information in each of said plurality of clusters.

104. (*Previously Presented*) The computer-readable medium of claim 103, wherein, in

said clustering of sorted feature vectors, said plurality of sorted feature vectors are clustered into

said plurality of clusters such that said amount of information in each of said plurality of clusters

does not exceed an amount of information in said first cluster.

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